Method and device for drying of paper.

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Abstract of **EP0559628**

Method and device in the drying of paper, especially of fine paper or newsprint. The paper web (W) to be dried is passed over the mantle face (23,24) of a large-diameter (D) flow-through cylinder (20). On the flow-through cylinder (20), a set of drying-gas jets (B1) is applied to the free outer face of the web (W) through a nozzle arrangement (29), water being evaporated outwards from the outer part of the web (W) by means of said set of drying-gas jets. The water vapour thus evaporated is removed through the spaces (18,28,10c) in the blowing-on hood (10). By means of the set of drying-gas jets (B1), the interior of the web (W) to be dried is also heated. The mantle face (23,24) of the flow-through cylinder (20) is cooled by means of a medium flow (WA). Water that has been vaporized out of the web (W) and that has been condensed onto the cooled faces is sucked by means of negative pressure present in the interior (22) of the flow-through cylinder (20).

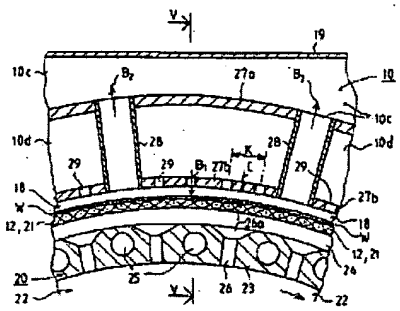

FIG. 4

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(54) **Method and device for drying of paper**

Verfahren und Vorrichtung zur Trocknung von Papier

Procédé et dispositif pour le séchage du papier

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Description

The invention concerns a method in the drying of paper, especially of fine paper or newsprint, wherein the paper web to be dried is passed over the mantle face of a large-diameter flow-through cylinder and on which flow-through cylinder a set of drying-gas jets is applied to the free outer face of the web through a nozzle arrangement, water being evaporated outwards from the outer part of the web by means of said set of drying-gas jets, and the water vapour thus evaporated is removed through the spaces in the blowing-on hood, and by means of which set of drying-gas jets the interior of the web to be dried is also heated.

Further, the invention concerns a dryer for paper, in particular for fine paper or newsprint, intended for carrying out a method of the invention, which dryer comprises a flow-through cylinder and a blowing-on hood fitted above said cylinder, said hood being provided with a nozzle arrangement, by whose means a set of drying-gas jets can be applied to the outer face of the paper web to be dried, which is passed over the flow-through cylinder.

In prior art, paper, such as newsprint and fine paper, is dried in a multi-cylinder dryer, which comprises a great number of drying cylinders in one row or in two rows placed one above the other. In the drying if tissue paper, in prior art, for example from US-A-3 541 697, so-called Yankee dryers are known, which comprise a large-diameter heated cylinder, on which a so-called blowing-on hood may be fitted. Inside this hood, a great number of nozzle pipes are fitted, through which pipes drying air jets are applied to the free web face at a high velocity. The mantle of a Yankee cylinder is solid and unperforated, and it is usually a steam-heated pressure vessel. In a conventional blowing-on hood, the evaporation takes place in one direction, because the water cannot be evaporated towards the smooth face of the Yankee cylinder.

The water evaporation capacity of a prior-art cylinder dryer per unit of area of cylinder face is about 15... 30 kg/h/sq. m. The corresponding evaporation capacity of a Yankee dryer provided with a blowing-on hood is of an order of 100...150 kg/h/sq.m.

As drawbacks of the prior-art multi-cylinder dryers can be considered the high cost of the construction and above all the abundant space required by it in the machine direction as well as the literally complicated draw of the web through the dryer, which draw is susceptible of disturbance.

The object of the present invention is to provide a novel dryer for paper, in particular for fine paper or newsprint, by whose means higher drying capacities are obtained, which are necessary, for example, with constantly increasing running speeds of the paper machines.

An object of the present invention is to increase the drying efficiency of dryers of paper by means of a novel solution so that the space taken by the dryer section in the machine direction can be reduced substantially even to one half from the prior-art solutions, in which case the investment costs are reduced decisively both in respect of the buildings and in respect of the machinery.

A further object of the invention is to provide a method and a dryer in which the detrimental transverse drying-shrinkage of the web can be brought under control better than in prior art.

Another object of the invention is to provide a method and a dryer in which the efficiency of the utilization of the drying energy is improved.

In view of achieving the objectives stated above and those that will come out later, the method of the invention is mainly characterized in that the mantle face of the flow-through cylinder is cooled by means of a medium flow, and that water that has been vaporized out of the web and that has been condensed onto the cooled faces is such by means of negative pressure present in the interior of said flow-through cylinder.

On the other hand, the device in accordance with the invention is mainly characterized in that the mantle of the flow-through cylinder is provided with a system of ducts, into which a cooling medium can be passed from a source of cooling medium, that the mantle of the flow-through cylinder is provided with through perforations, that on said mantle there is an outer mantle, into whose ducts or capillaries the outer parts of said perforations are opened, and that, onto the outer face of said outer mantle, a drying fabric has been passed or an equivalent wire sock that constitutes a coating on the cylinder has been applied.

In the method of the invention, the hot drying-gas jets applied from the blowing-on hood to the outer face of the web vaporize water from the outer parts of the web and, at the same time, heat the inner parts of the web. The inner parts of the web are in contact with the cooled faces, by whose effect the water vapour evaporated from the web is condensed and, by the effect of the suction present in the interior of the flow-through cylinder, carried into the interior of the cylinder, from where it is removed by means of a suction pump.

In the following, the invention will be described in detail with reference to some exemplifying embodiments of the invention illustrated in the figures in the accompanying drawing, the invention being by no means strictly confined to the details of said embodiments.

Figure 1 is a schematic side view of a first embodiment of the invention.

Figure 2 illustrates a second embodiment of the invention in a way similar to Fig. 1.

Figure 3 is an illustration in part of a third embodiment of the invention.

Figure 4 is a vertical sectional view in the machine direction of the mantle of a Yankee cylinder in accordance with the invention and of the mantle of its blowing-on hood.

Figure 5 is a sectional view taken along the line V-V in Fig. 4.

Figure 6 shows the detail DET encircled in Fig. 5 on an enlarged scale.

Figure 7 illustrates the process diagram of a preferred embodiment of the method and the device in accordance with the invention.

A dryer for paper, in particular for newsprint and fine paper, as shown in Figs. 1 and 2 comprises a large-diameter flow-through cylinder 20, whose diameter D is, as a rule, in a range of D = 2...5 m, preferably D ≈ 3.5 m. The cylinder 20 is enclosed by a blowing-on hood 10, which covers the cylinder 20 over a sector 360° - α, whose magnitude is about 260°...320°, in which case the sector of the cylinder 20 that remains free from the hood 10 and from the web W to be dried is α = 40°... 100°. The blowing-on hood 10 is divided by a transverse partition wall 11 into two compartments 10a and 10b, in which it is possible to apply drying parameters different from compartment to compartment.

According to Fig. 1, the web W_{in} to be dried is passed on a relatively permeable drying fabric 12 over the first steam-heated drying cylinder 13, on which at least pre-heating and possibly also pre-drying of the web W is performed. After this, the web W is transferred on the straight run of the fabric 12 onto the cylinder 20. Into the inlet nip N+ between the fabric 12 and the cylinder 20 mantle 23, a positive pressure tends to be induced, which attempts to separate the web W from the fabric 12. This positive pressure is counteracted by means of a blow box 15, by whose means air is ejected out of the inlet nip N+, thereby attempting to bring the nip to the normal pressure or to a slight negative pressure.

According to Figs. 1 and 2, the web W runs on the sector 360° - α around the cylinder 20 and leaves the cylinder and the interior of the hood 10 at end of said sector, passing on the straight run of the fabric 12 onto the latter drying cylinder 14, on which the web W is after-dried. Hereupon the dried web W_{out} is transferred further to reeling. In some special cases, it is possible to use two through-dryers in accordance with the invention placed one after the other, which dryers are preferably arranged to operate so that the web sides are reversed in the latter drying stage. Between the different drying stages, it is preferable to employ closed draw in order to ensure a sufficiently high web speed.

The dryer shown in Fig. 2 is in the other respects similar to that shown in Fig. 1 except that therein the web W_{in} is passed on the fabric 12 around the first paper guide roll 13a onto the cylinder 20 and removed from said cylinder on the latter paper guide roll 14a, so that heated drying cylinders are not employed in this embodiment. In this embodiment, the sector α is also considerably smaller than in Fig. 1.

Fig. 3 differs from the concepts of Figs. 1 and 2 in the respect that the web W_{in} is brought on the first drying fabric 12a around the suction sector 16a of the suction-transfer roll 16. The web W is separated from the first fabric 12a in the transfer nip N_a with slight load, which nip is formed between the cylinder 20 and the suction-transfer roll 16. In a corresponding way, at the rear side of the cylinder 20, the web W is transferred in the transfer nip N_b of the second suction-transfer roll 17 onto the second fabric 12b, and on support of said fabric further over the suction zone 17a of the second suction-transfer roll 17. Thus, in Fig. 3, the drying fabric 12 that brings in the web W and that carries it further does not run around the cylinder 20, but the face of the cylinder 20 is coated with a wire-sock loop 21 fixed to the cylinder, the construction and the permeability of said sock being similar to the drying fabric 12.

Figs. 4, 5 and 6 disclose the construction in accordance with the invention of the drying cylinder and of the blowing-on hood 10. The blowing-on hood 10 is provided with outer walls 19, which define exhaust spaces 10c in their interior. Inside these spaces 10c, there are two walls 27a and 27b shaped as parts of a circular cylinder, of which walls the inner wall 27b is placed at the distance of a small free gap 18 from the free outer face of the web W, which runs on the fabric 12 or on the wire sock 21. The radial dimension C of the space 18 is, as a rule, in a range of C = 10...50 cm, preferably C ≈ 25 cm.

Between them, the partition walls 27a and 27b define a space 10d. In the inner partition wall 27b, there is a series of nozzle openings 29, whose diameter φ is, as a rule, in a range of φ = 2...6 mm, preferably φ ≈ 4 mm. The open area formed by the nozzle holes 29, i.e. the percentage of holes, is, as a rule, in a range of 1...6 % of the area of the wall 27a.

The mantle 23 of the flow-through cylinder 20 is provided with axial bores 25, through which a flow of cooling water WA has been arranged in a way that will come out later. Between the bores 25 extending over the entire length of the mantle 23 there are radial bores 26, whose outer orifices are provided with widened portions 26a. On the outer face of the cylinder mantle 23, there is a permeable outer mantle 24, which is, according to Fig. 6, made of profile band 24a by winding. The profile band 24a is provided with pin-shaped spacer pieces 24b, which define gaps 24c between the profile-band layers, through which gaps flow of medium can take place through the outer mantle 24 in the direction of the arrow B. The spacer pieces 24b are, for example, pin-shaped parts of circular section, which are placed on the profile band 24a in two rows with suitably small intervals. The gaps 24c between the profile bands 24a are opened into the widenings 26a in the bores 26. Thus, the mantle 23 and its outer part 24 are permeable into the interior space 22 of the cylinder 20.

In stead of an outer mantle 24 made of profile band 24a, it is possible to use a corresponding permeable mantle layer, which is made, e.g., of a felt-like or mesh-like material or of a sintered material which is provided with capillaries.

Fig. 7 illustrates a preferred embodiment of the drying process. Along the air duct 31a of the first compartment 10a of the hood 10, in the direction of the arrow

I_{in}, replacement air is passed to the combustion unit 32a, in which the blowing-on air for the web W is heated, e. g., to about 350°C. Out of said combustion unit 32a, hot air is blown into the space 10d between the walls 27a and 27b, out of which space 10d the hot air is discharged through the nozzle holes 29 as sharp jets in the direction of the arrows B_1 at a high velocity ($v \approx 90$ m/s) against the outer face of the web W to be dried and produces a so-called "impingement" drying effect, by whose means water vapour is evaporated out of the outer part of the web outwards, and the water vapours thus evaporated are discharged through the spaces 18,28,10c in the flow-through hood 10, and by the effect of said drying-gas jets, the water contained in the interior of the web is also vaporized. From the intermediate space 18 outside the web W, through the pipes 28, in the direction of the arrows B_2, exhaust-air flows are passed into the space 10c, and from there further through the duct 35 to the heat recovery system 34 and from it further, by means of the blower 33a, as recirculation air I_k, to be combined with the replacement air flow I_{in}. A corresponding system operates in the latter compartment 10b in the blowing-on hood 10, which compartment is separated by the partition walls 11 at the spaces 10c and 10d. The latter compartment 10b also includes a drying-air system similar to that described above and comprising a replacement-air duct 31b, a combustion unit 32b, a recirculation-air duct 35b, and a circulation air blower 33b and a heat-recovery system 34.

For the purpose of cooling the mantle 23 of the cylinder 20, a flow of cooling water WA is passed by means of a cooling-water pump 36 along the duct 37 into the cylinder, from where it is distributed by means of a pipe duct 37a into a ring pipe 37b and through branch pipes 37c branched from same into the bores 25 in the cylinder mantle 23. At the opposite ends of the bores 25, there are corresponding water draining ducts and exhaust ducts.

Into the interior space 22 in the cylinder 20, negative pressure is produced, which is preferably of an order of 10...30 kPa. This takes place through a suction duct 38 placed in connection with one of the axle journals of the cylinder 20. The suction duct 38 communicates with a suction duct 39, which communicates with a suction pump 40, which removes both air and water that has been separated from the web W.

In the following, the drying method carried out by the device described above will be described. The water vapour evaporated from the interior of the web W is carried through the fabric 12;21 onto the cooled cylinder face 24,23, where the condensed water is sucked into the capillaries or grooves 24c that form the hollow face and further into the bores 26a,26 by the effect of the negative pressure that prevails in the interior 22 of the cylinder 20. By means of the negative pressure, the water is also drained mainly in the area α not covered by the web W, in which area the water operates as a "seal" in the ducts 26,26a,24c in the mantle 23 in the way of a water seal, whereby the use of a relatively high negative pressure in the interior 22 of the cylinder 20 is possible.

The drying takes place so that thermal energy is transferred from the hot air blown B_1 onto the web W into the wet web W, whereby evaporation of water takes place in the web W. On the outer face of the web W, nothing prevents the evaporated vapour from being carried into the exhaust ducts 18,28,10c. At its inner face, the web W is supported by a mesh-like drying fabric 12; 21. When temperature of the fabric 12;21 and of the outer face 23,24 of the cylinder 20 is kept low, the vapour evaporated from the inner face of the web W is condensed as water onto said cold faces. The colder the faces, the lower can the temperature of the water vapour be that is condensed on said faces.

Since the vapour evaporated from the inner face of the paper web is condensed to water, the resistance to the flow of water vapour that would be constituted by the fabric 12;21 is avoided. Thus, the drying of the web W can take place efficiently through both faces of the web.

In order that blowing-through should also occur in the case of newsprint with the dry solids contents used in the drying method, the negative pressure in the interior 22 of the cylinder 20 must be of an order of 10...30 kPa. At this level of negative pressure, the vaporization temperature of water is of an order of 90°C. Thus, when the temperature of the inner face of the web W is higher than 90°C, the water contained in it is vaporized. On the other hand, when the temperature of the cooled outer face of the cylinder 20 is lower than 90°C, the water vapour tends to be condensed on it.

In the method and dryer in accordance with the invention, a difference in pressure acts upon the web W throughout the entire process of drying, which difference in pressure fixes the web firmly onto the outer face of the fabric 12 or of the corresponding wire sock 21. Hereby, the substantial advantage is obtained that, during the drying, the web cannot shrink in the transverse direction, which has been the case, e.g., in the prior-art cylinder dryers. This shrinkage has a number of detrimental effects, e.g., on different transverse profiles of the web, such as the profiles of fibre orientation. This problem is also solved in the present invention in a novel way.

The scope of the invention also includes embodiments of equipment in which no fabric 12 or equivalent wire sock 21 is employed. In such a case, on the cylinder 20, such a capillary face 24 is employed as does not mark the web to a detrimental extent, the face of said web entering in direct contact with said capillary face.

In the following, the patent claims will be given, and the different details of the invention may show variation within the scope of the inventive idea defined in said claims and differ from the details stated above for the sake of example only.

Claims

1. Method in the drying of paper, especially of fine paper or newsprint, wherein the paper web (W) to be dried is passed over the mantle face (23,24) of a large-diameter (D) flow-through cylinder (20) and on which flow-through cylinder (20) a set of drying-gas jets (B_1) is applied to the free outer face of the web (W) through a nozzle arrangement (29), water being evaporated outwards from the outer part of the web (W) by means of said set of drying-gas jets, and the water vapour thus evaporated is removed through the spaces (18,28,10c) in the blowing-on hood (10), and by means of which set of drying-gas jets (B_1) the interior of the web (W) to be dried is also heated, **characterized** in that the mantle face (23,24) of the flow-through cylinder (20) is cooled by means of a medium flow (WA), and that water that has been vaporized out of the web (W) and that has been condensed onto the cooled faces is sucked by means of negative pressure present in the interior (22) of said flow-through cylinder (20).

2. Method as claimed in claim 1, **characterized** in that, in the method, in the interior of the flow-through cylinder (20), a negative pressure is employed, which is in a range of 2...30 kPa, preferably ≈ 10... 20 kPa, and that the temperature T of the gas in said set of drying-gas jets (B_1) is arranged in a range of T = 250...500°C, preferably T ≈ 400°C.

3. Method as claimed in claim 1 or 2, **characterized** in that, before and/or after said flow-through cylinder (20), the web (W) is pre/after-heated by means of a heated drying cylinder (13, 14).

4. Method as claimed in any of the claims 1 to 3, **characterized** in that the blowing-on hood (10) is divided into at least two compartments (10a, 10b) placed one after the other in the running direction of the web (W), in which compartments individual drying parameters are applied.

5. Method as claimed in any of the claims 1 to 4, **characterized** in that the web (W) is passed over said flow-through cylinder over a sector (360 - α), whose magnitude is arranged in a range of 260°...320°, preferably in a range of 270°.

6. Dryer for paper, in particular for fine paper or newsprint, intended for carrying out a method as claimed in any of the claims 1 to 5, which dryer comprises a flow-through cylinder (20) and a blowing-on hood (10) fitted above said cylinder, said hood being provided with a nozzle arrangement (29), by whose means a set of drying-gas jets (B_1) can be applied to the outer face of the paper web (W) to be dried, which is passed over the flow-through cylinder (20), **characterized** in that the mantle (23,24) of the flow-through cylinder (20) is provided with a system of ducts (25), into which a cooling medium (WA) can be passed from a source (36) of cooling medium, that the mantle (23) of the flow-through cylinder (20) is provided with through perforations (26,26a), that on said mantle (23) there is an outer mantle (24), into whose ducts (24c) and/or capillaries the outer parts (26a) of said perforations (26) are opened.

7. Dryer as claimed in claim 6, **characterized** in that, onto the outer face of said outer mantle (24), a drying fabric (12) has been passed or a corresponding wire sock (21) that constitutes a coating on the cylinder has been applied.

8. Dryer as claimed in claim 6 or 7, **characterized** in that the radial perforations (26) in the flow-through cylinder (20) have widened outer orifices (26a), which communicate with several grooves and/or capillaries in the outer mantle (24).

9. Dryer as claimed in any of the claims 6 to 8, **characterized** in that said outer mantle (24) is formed of a profile band (24a) by winding, and that on the profile band (24a), on one or both of its vertical sides, there are spacer pieces (24b), such as pins or equivalent, which determine narrow ducts (24c) between successive windings of the profile band (24a), said ducts communicating with the perforations (26) in the cylinder mantle (23), preferably with their widened orifices (26a)(Fig. 6).

10. Dryer as claimed in any of the claims 6 to 9, **characterized** in that the web (W) is passed on a drying fabric (12) over the flow-through cylinder (20) over a sector whose magnitude is in a range of 260°... 320°, and that, before and/or after the flow-through cylinder (20), a drying cylinder (13, 14) and/or a paper guide roll (13a, 14a) is/are fitted.

11. Dryer as claimed in any of the claims 6 to 10, **characterized** in that the paper web (W_{in}) to be dried is brought onto the flow-through cylinder (20) on a first wire (12a), from which it is transferred, after the suction zone (16a) of the transfer-suction roll (16), in a transfer nip (N_a), onto the wire-sock face (21) of the flow-through cylinder, and that the web (W) is passed away from said flow-through cylinder (20) on a second wire (12b) by transferring it in a transfer nip (N_b), at the beginning of the suction zone (17a) of the transfer-suction roll (17), onto said second wire (12b), and on said wire further (Fig. 3).

12. Dryer as claimed in any of the claims 6 to 11, **characterized** in that the blowing-on hood (10) has been divided into at least two compartments (10a, 10b) placed one after the other in the running direction

of the web (W), that into each compartment (10a, 10b), a replacement-air duct (31a,31b) has been brought through a heating device (32a,32b), such as a combustion unit, that from each compartment (10a,10b), a recirculation-air flow has been taken, which is passed through a heat exchanger (34) and a circulation-air blower (33a,33b) back to the circulation of drying air, that an axle journal of said flow-through cylinder (20) is provided with a duct (38), which communicates with a vacuum pump (40), and that the bores (25) in the mantle (23) of said flow-through cylinder (20) communicate through a ring pipe (37b) or equivalent with a cooling-water pipe (37) connected with the cooling-water pump (36) (Fig.7).

Patentansprüche

1. Verfahren in der Trocknung von Papier, insbesondere von Feinpapier oder Zeitungsdruckpapier, wobei die zu trocknende Papierbahn (W) über die Mantelfläche (23, 24) eines Durchflußzylinders (20) mit großem Durchmesser (D) geleitet wird und auf welchem Durchflußzylinder (20) ein Satz von Trocknungsgasstrahlen (B_1) durch eine Düsenanordnung (29) auf die freie Außenfläche der Bahn (W) aufgetragen wird, wobei Wasser von dem Außenteil der Bahn (W) mittels des Satzes von Trocknungsgasstrahlen nach außen verdampft und der somit verdampfte Wasserdampf durch die Räume (18, 28, 10c) in der Anblashaube (10) entfernt wird, wobei mittels des Satzes von Trocknungsgasstrahlen (B_1) das Innere der zu trocknenden Bahn (W) ebenso erwärmt wird, dadurch gekennzeichnet, daß die Mantelfläche (23, 24) des Durchflußzylinders (20) mittels einer Mittel strömung (WA) gekühlt wird, und daß Wasser, das aus der Bahn (W) verdampft worden ist und das auf die gekühlten Flächen kondensiert worden ist, mit Hilfe von in dem Inneren (22) des Durchflußzylinders (20) herrschenden Unterdruck abgesaugt wird.

2. Verfahren gemäß Patentanspruch 1, dadurch gekennzeichnet, daß in dem Verfahren im Inneren des Durchflußzylinders (20) ein Unterdruck angewendet wird, der in einem Bereich von 2 bis 30 kPa, vorzugsweise ≈ 10 bis 20 kPa, liegt, und daß die Temperatur T des Gases in dem Satz von Trocknungsgasstrahlen (B_1) in einem Bereich von T = 250 bis 500 °C, vorzugsweise T ≈ 400 °C, eingerichtet ist.

3. Verfahren gemäß Patentanspruch 1 oder 2, dadurch gekennzeichnet, daß vor und/oder nach dem Durchflußzylinder (20) die Bahn (W) mittels eines erwärmten Trocknungszylinders (13, 14) vor-/nachgewärmt wird.

4. Verfahren gemäß einem der Patentansprüche 1 bis 3, dadurch gekennzeichnet, daß die Anblashaube (10) in zumindest zwei Abteile (10a, 10b) unterteilt ist, die in Laufrichtung der Bahn (W) nacheinander angeordnet sind, in welchen Abteilen individuelle Trocknungsparameter angewendet werden.

5. Verfahren gemäß einem der Patentansprüche 1 bis 4, dadurch gekennzeichnet, daß die Bahn (W) über einen Sektor (360-α), dessen Größenordnung in einem Bereich von 260° bis 320°, vorzugsweise in einem Bereich von 270°, eingerichtet ist, um den Durchflußzylinder geleitet wird.

6. Trockner für Papier, insbesondere für Feinpapier oder Zeitungsdruckpapier, zur Durchführung eines Verfahrens gemäß einem der Patentansprüche 1 bis 5, welcher Trockner einen Durchflußzylinder (20) und eine über dem Zylinder angebrachte Anblashaube (10) aufweist, wobei die Haube mit einer Düsenanordnung (29) versehen ist, mit deren Hilfe ein Satz von Trocknungsgasstrahlen (B_1) auf die Außenfläche der zu trocknenden Papierbahn (W) aufgetragen werden kann, welche um den Durchflußzylinder (20) geleitet wird, dadurch gekennzeichnet, daß der Mantel (23, 24) des Durchflußzylinders (20) mit einem System von Kanalleitungen (25) versehen ist, in welches ein Kühlmittel (WA) von einer Kühlmittelquelle (36) geleitet werden kann, daß der Mantel (23) des Durchflußzylinders (20) mit Durchlaßperforationen (26, 26a) versehen ist, und daß sich an dem Mantel (23) ein Außenmantel (24) befindet, in dessen Kanalleitungen (24c) und/oder Kapillaren die Außenteile (26a) der Perforationen (26) geöffnet sind.

7. Trockner gemäß Patentanspruch 6, dadurch gekennzeichnet, daß auf die Außenfläche des Außenmantels (24) ein Trocknungsfilz (12) geleitet worden ist oder ein entsprechendes Schrumpfsieb (21) aufgetragen worden ist, das einen Überzug auf dem Zylinder bildet.

8. Trockner gemäß Patentanspruch 6 oder 7, dadurch gekennzeichnet, daß die radialen Perforationen (26) in dem Durchflußzylinder (20) ausgeweitete äußere Öffnungen (26a) haben, die mit mehreren Rillen und/oder Kapillaren im Außenmantel (24) in Verbindung stehen.

9. Trockner gemäß einem der Patentansprüche 6 bis 8, dadurch gekennzeichnet, daß der Außenmantel (24) durch Umwickeln aus einem Profilband (24a) gebildet ist, und daß an dem Profilband (24a), und zwar an seiner einen oder seinen beiden vertikalen Seiten, Abstandhalterstücke (24b), wie etwa Stifte oder dergleichen, vorhanden sind, die zwischen aufeinanderfolgenden Umwicklungen des Profil-

bandes (24a) enge Kanalleitungen (24c) bestimmen, wobei die Kanalleitungen mit den Perforationen (26) in dem Zylindermantel (23), vorzugsweise mit ihren ausgeweiteten Öffnungen (26a), in Verbindung stehen (Fig. 6).

10. Trockner gemäß einem der Patentansprüche 6 bis 9, dadurch gekennzeichnet, daß die Bahn (W) auf einem Trocknungsfilz (12) um den Durchflußzylinder (20) geleitet wird, und zwar um einen Sektor, dessen Größenordnung in einem Bereich von 260° bis 320° liegt, und daß vor und/oder nach dem Durchflußzylinder (20) ein Trocknungszylinder (13, 14) und/oder eine Papierleitwalze (13a, 14a) angebracht ist/sind.

11. Trockner gemäß einem der Patentansprüche 6 bis 10, dadurch gekennzeichnet, daß die zu trocknende Papierbahn (W_{ein}) auf den Durchflußzylinder (20) aufgebracht wird, und zwar auf einem ersten Sieb (12a), von welchem sie nach der Saugzone (16a) der Transfersaugwalze (16) in einem Transferspalt (N_a) auf die Schrumpfsieboberfläche (21) des Durchflußzylinders transferiert wird, und daß die Bahn (W) dadurch von dem Durchflußzylinder (20) auf einem zweiten Sieb (12b) weggeleitet wird, daß sie in einem Transferspalt (N_b) zu Beginn der Saugzone (17a) der Transfersaugwalze (17) auf das zweite Sieb (12b) und auf dem Sieb weiter transferiert wird (Fig. 3).

12. Trockner gemäß einem der Patentansprüche 6 bis 11, dadurch gekennzeichnet, daß die Anblashaube (10) in zumindest zwei Abteile (10a, 10b) unterteilt worden ist, die in Laufrichtung der Bahn (W) nacheinander angeordnet sind, daß in jedes Abteil (10a, 10b) eine Austauschluft-Kanalleitung (31a, 31b) durch eine Heizvorrichtung (32a, 32b), wie etwa eine Verbrennungseinheit, eingebracht worden ist, daß von jedem Abteil (10a, 10b) eine Umluftströmung entnommen worden ist, die durch einen Wärmetauscher (34) und ein Umluftgebläse (33a, 33b) zurück zum Trocknungsluftumlauf geleitet wird, daß ein Lagerzapfen des Durchflußzylinders (20) mit einer Kanalleitung (38) versehen ist, die mit einer Vakuumpumpe (40) in Verbindung steht, und daß die Bohrungen (25) in dem Mantel (23) des Durchflußzylinders (20) durch eine Ringleitung (37b) oder dergleichen mit einer Kühlwasserleitung (37), die mit der Kühlwasserpumpe (36) verbunden ist, in Verbindung stehen (Fig. 7).

Revendications

1. Dispositif pour le séchage du papier, en particulier pour le papier fin ou le papier journal, dans lequel la bande continue de papier (W) à sécher est amenée sur la face de l'enveloppe ou chemise (23, 24) d'un cylindre de passage (20) de grand diamètre (D) et cylindre de passage (20) sur lequel est appliquée une série de jets de gaz de séchage (B_1) sur la face extérieure libre de la bande continue (W) par l'intermédiaire d'un dispositif de tuyère (29), l'eau étant évaporée vers l'extérieur à partir de la partie extérieure de la bande continue (W) au moyen de la série de jets de gaz de séchage, et la vapeur d'eau ainsi évaporée est évacuée par les espaces (18, 28, 10c) dans le capuchon de soufflage (10) et au moyen de laquelle série de jets de gaz de séchage (B_1) est également chauffé l'intérieur de la bande continue (W) à sécher, caractérisé en ce que la face de chemise (23, 24) du cylindre de passage (20) est refroidie par un flux de milieu (WA) et en ce que l'eau qui s'est vaporisée de la bande continue (W) et s'est condensée sur les faces refroidies est aspirée par la dépression ou le vide présent à l'intérieur (22) du cylindre de passage (20).

2. Procédé selon la revendication 1, caractérisé en ce que dans le procédé à l'intérieur du cylindre de passage (20), on utilise une dépression ou vide qui se situe dans la plage de 2... 30 kPa, de préférence ≈ 10.... 20 kPa, et en ce que la température T du gaz dans la série de jets de gaz de séchage (B_1) est disposée dans une plage de T = 250... 500°C, de préférence T ≈ 400°C.

3. Procédé selon la revendication 1 ou 2, caractérisé en ce qu'avant et/ou après le cylindre de passage (20), la bande continue (W) est soumise à un chauffage préalable/ultérieur au moyen d'un cylindre de séchage chauffé (13, 14).

4. Procédé selon l'une quelconque des revendications 1 à 3, caractérisé en ce que le capuchon de soufflage (10) est divisé en au moins deux compartiments (10a, 10b) placés l'un après l'autre dans la direction de défilement de la bande continue (W), compartiments dans lesquels sont appliqués les paramètres de séchage individuels.

5. Procédé selon l'une quelconque des revendications 1 à 4, caractérisé en ce que la bande continue (W) passe par le cylindre de passage sur un secteur (360 - α), dont la grandeur se situe dans une plage de 260°... 320°, de préférence dans la plage de 270°.

6. Dispositif de séchage pour papier, en particulier pour papier fin ou papier journal, prévu pour réaliser un procédé selon l'une quelconque des revendications 1 à 5, lequel dispositif de séchage comprend un cylindre de passage (20) et un capuchon de soufflage (10) monté sur le cylindre, ce capuchon étant muni d'un dispositif à tuyère (29) au moyen

duquel on peut appliquer une série de jets de gaz de séchage (B_1) sur la face extérieure de la bande continue de papier (W) à sécher, qui est amenée sur le cylindre de passage (20), caractérisé en ce que la face de chemise (23, 24) du cylindre de passage (20) est munie d'un système de conduite (25) dans lequel on fait passer un milieu de refroidissement (WA) à partir d'une source (36) de milieu de refroidissement, en ce que la chemise (23) du cylindre de passage (20) est munie de perforations traversantes (26, 26a), en ce que sur la chemise (23) est prévue une chemise extérieure (24), dans les conduits (24c) et/ou capillaires de laquelle débouchent les parties extérieures (26a) des perforations (26).

7. Dispositif de séchage selon la revendication 6, caractérisé en ce que sur la face extérieure de la chemise extérieure (24), a été appliqué un tissu de séchage (12) ou une enveloppe de toile correspondante (21) qui constitue un revêtement pour le cylindre.

8. Dispositif de séchage selon la revendication 6 ou 7, caractérisé en ce que les perforations radiales (26) dans le cylindre de passage (20) comportent des orifices extérieurs élargis (26a) qui communiquent avec plusieurs gorges et/ou capillaires dans la chemise extérieure (24).

9. Dispositif de séchage selon l'une quelconque des revendications 6 à 8, caractérisé en ce que la chemise extérieure (24) est constituée d'une bande de profil (24a) par enroulement et en ce que sur la bande de profil (24a) sur un de ses côtés verticaux ou sur ses deux côtés verticaux, sont prévus des éléments d'espacement (24b) tels que des goupilles ou équivalents qui déterminent des conduits étroits (24c) entre les enroulements successifs de la bande de profil (24a), ces conduits communiquant avec les perforations (26) dans la chemise de cylindre (23), de préférence avec leurs orifices élargis (26a) (figure 6).

10. Dispositif de séchage selon l'une quelconque des revendications 6 à 9, caractérisé en ce que la bande continue de papier (W) défile sur un tissu de séchage (12) sur le cylindre de passage (20) selon un secteur dont la grandeur est dans la plage de 260°.... 320°, et en ce que, avant et/ou après le cylindre de passage (20), est ou sont prévu(s) un cylindre de séchage (13, 14) et/ou un rouleau de guidage de papier (13a, 14a).

11. Dispositif de séchage selon l'une quelconque des revendications 6 à 10, caractérisé en ce que la bande continue de papier (W_{in}) à sécher est amenée sur le cylindre de passage (20) sur une première toile (12a) à partir de laquelle elle est transférée, après la zone d'aspiration (16a) du rouleau d'aspiration de transfert (16), dans une emprise de transfert (N_a), sur la face de l'enveloppe de toile (21) du cylindre de passage, et en ce que la bande continue de papier (W) est transférée depuis le cylindre de passage (20) sur une seconde toile (12b) par passage dans une emprise de transfert (N_b), au début de la zone d'aspiration (17a) du rouleau d'aspiration de transfert (17), sur la seconde toile (12b) et au-delà sur cette toile (figure 3).

12. Dispositif de séchage selon l'une quelconque des revendications 6 à 11, caractérisé en ce que le capuchon de soufflage (10) a été divisé en au moins deux compartiments (10a, 10b) placés l'un après l'autre dans la direction de défilement de la bande continue de papier (W), en ce que dans chaque compartiment (10a, 10b), un conduit d'air de remplacement (31a, 31b) est amené à travers un dispositif de chauffage (32a, 32b), tel qu'une unité de combustion, en ce qu'à partir de chaque compartiment (10a, 10b), un flux d'air de recirculation a été prélevé et amené par un échangeur de chaleur (34) et une soufflante d'air de circulation (33a, 33b) en retour à la circulation de l'air de séchage, en ce qu'un tourillon du cylindre de passage (20) est muni d'un conduit (38) qui communique avec une pompe de vide (40), et en ce que les alésages (25) dans la chemise (23) du cylindre de passage (20) communiquent par une conduite annulaire (37b) ou équivalent avec une conduite d'eau de refroidissement (37) raccordée à la pompe d'eau de refroidissement (36) (figure 7).

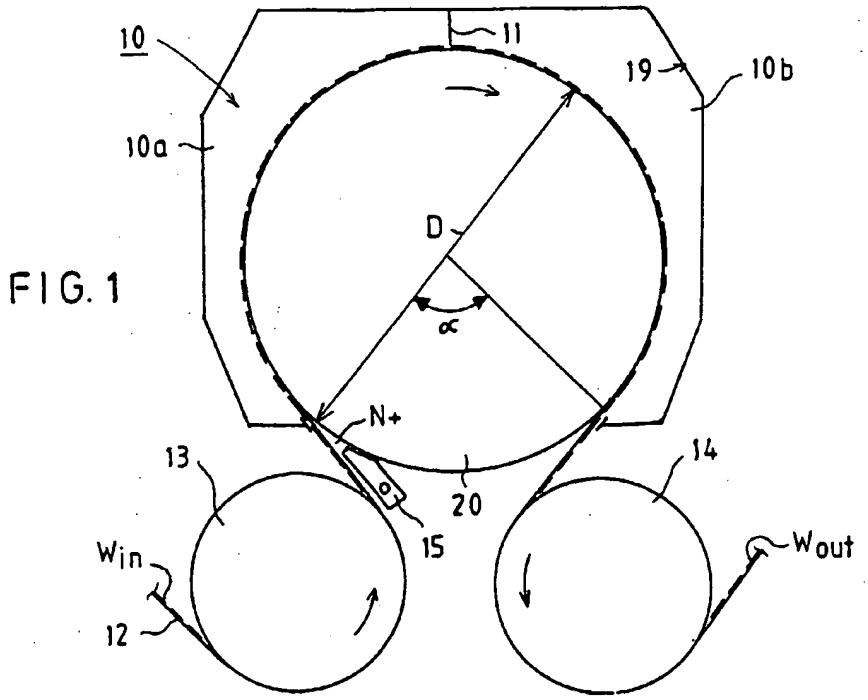

FIG. 1

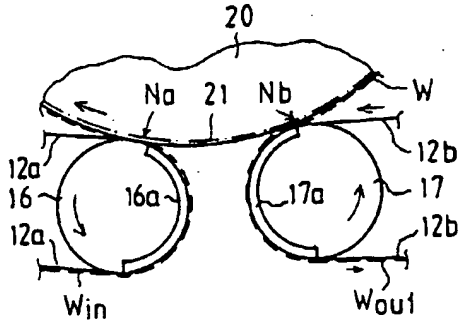

FIG. 3

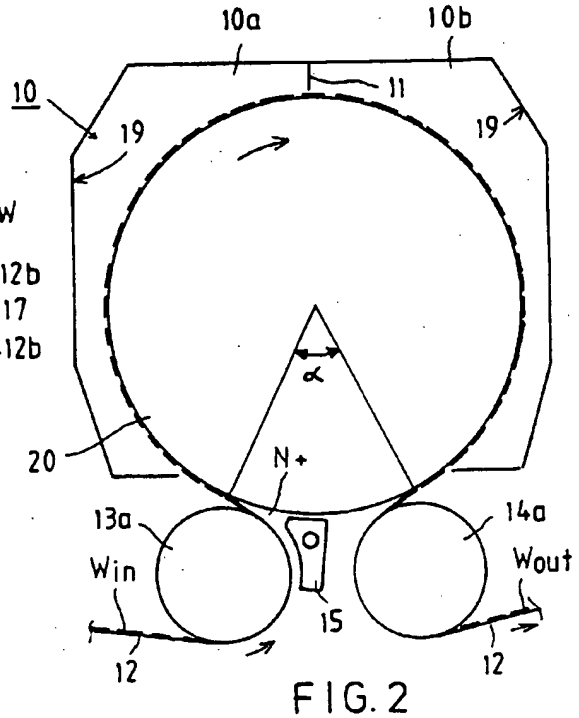

FIG. 2

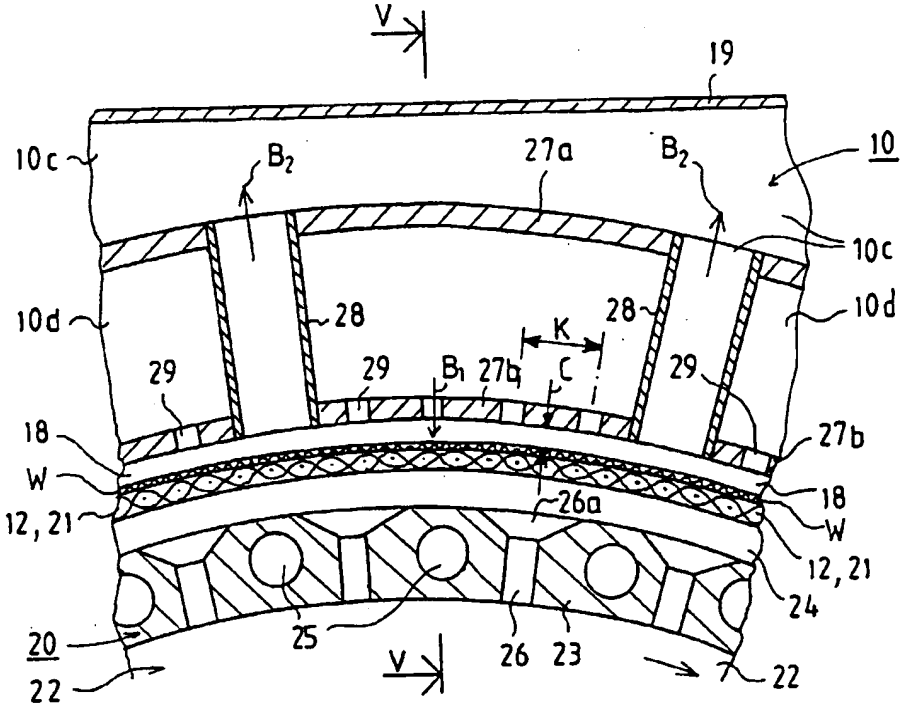

FIG. 4

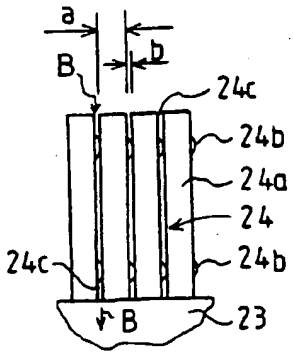

FIG. 6

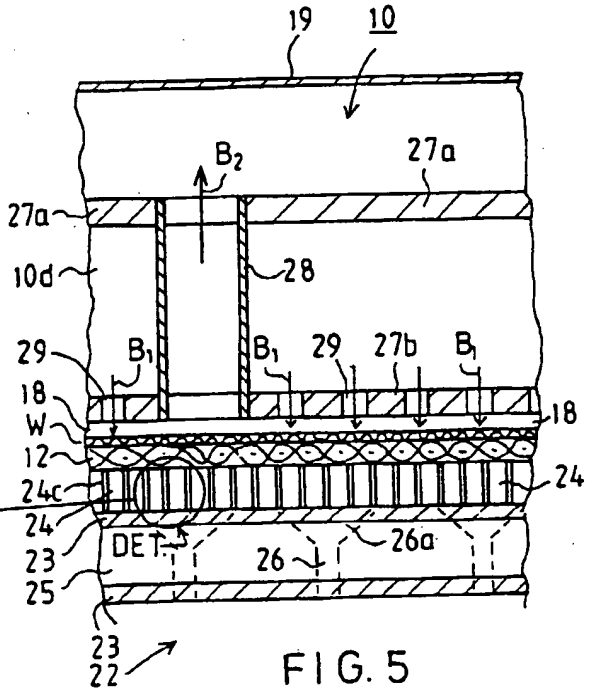

FIG. 5

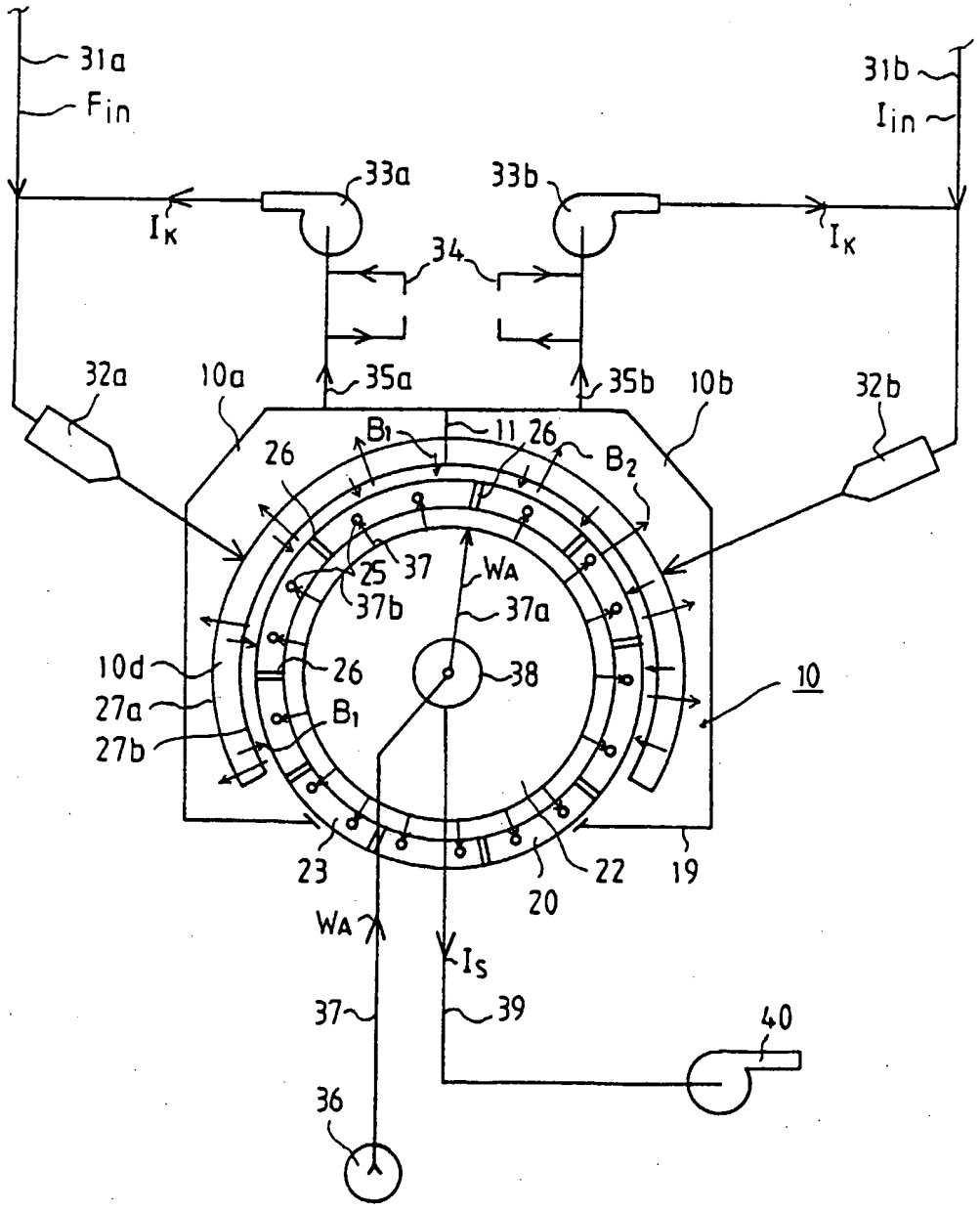
31a
Fin
31b
Iin
33a
33b
IK
IK
34
32a
10a
35a
35b
10b
32b
B1
11
26
B2
26
25
37
WA
37b
37a
10d
26
38
10
27a
B1
27b
23
22
19
20
WA
IS
37
39
40
36

FIG.7